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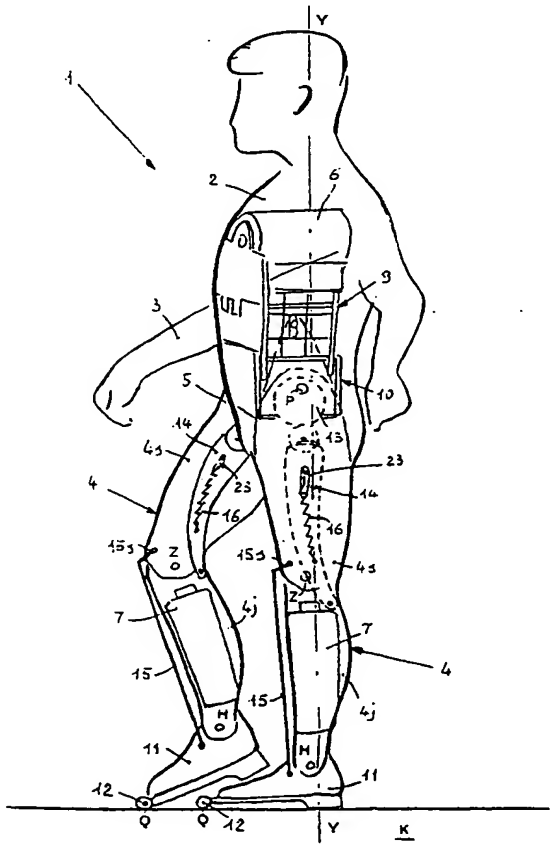
(54) Title: DOLL SIMULATING A WALKING ACTION



(57) Abstract: A description is given of a doll (1) provided with a trunk (2), arms (3) and, hinged to the hips (5), legs (4), which simulates walking. It comprises: a) an electric motor (6) with batteries (7); b) a device (9), driven by the electric motor (6), that rotates the upper portions (4s) of the legs in mutually opposite alternating directions. Each leg (4) is composed of an upper portion (4s), a lower portion (4j) and a foot (11), these being articulated to each other, and comprises means (13, 14, 15, 16) that cause them to rotate relative to each other when the leg (4) contracts in order to take a step, while nonetheless keeping a constant distance between the articulation (P) of the leg (4) to the hip (5) and the point of contact (Q) on the floor or suchlike surface (K) by which a rolling member (12) at the toe of the foot (11) is supported at all times.

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DOLL SIMULATING A WALKING ACTION

The present invention relates to the toy industry, more specifically that sector of the industry that produces dolls animated by mechanical or electromechanical devices to simulate the movements of walking.

Hitherto, all such doll products have failed to achieve the object of presenting a sufficiently realistic simulation of these movements because in virtually all cases, in order to simulate walking without the doll losing balance, its legs move by sliding or rolling its feet over the floor or suchlike surface while the trunk remains rigid with respect to the hips.

This combination of factors gives the walking motion of a doll the familiar appearance of a robot's movements.

The inventor of this innovation has instead devised a doll having a range of technical features that enable it to give a perfect simulation of the walking movements of a human being, if desired even with the trunk swaying rhythmically from side to side and with legs hinged to the hips of the doll and composed, like those of the human body, of an upper portion, a lower portion and a foot, all articulated together, which, as the doll advances, rotate relative to each other in a similar way to a leg of a human being as it takes a step.

A number of devices applied to the doll and which will be described in greater detail in the course of this account, all connected rigidly by transmission members to a battery-powered electric motor, move the various parts of the doll in a suitably synchronized and coordinated fashion in such a way as to recreate the same movements as those of the human body as it walks along.

Even the feet tilt rhythmically up and down relative to the floor or suchlike surface, and, in the

course of one step, the foot of the leg held vertically rests on the ground while that of the moving leg whose points of articulation are bending, rests on the ground only via a rolling member mounted on its toe.

The subject of the present invention is therefore a doll as described in the preamble of the attached Claim 1, as characterized by the characterizing part of the same claim.

A more detailed description now follows of a number of preferred embodiments of the doll according to the invention. These are not to be understood as binding or exclusive of other embodiments that can be produced on the basis of the teachings of the abovementioned Claim 1. In the course of the description reference will also be made to the appended drawings, which show:

- in Figure 1, a see-through side view of one of the said preferred embodiments of a doll according to the invention simulating the movements of walking;
- in Figure 2, a partial see-through side view of the same, showing certain parts housed inside the trunk of the doll of Figure 1;
- in Figure 3, a see-through perspective view of the same, revealing parts and devices of the doll, including the device that causes the trunk to sway relative to the hips;
- in Figure 4, a partial see-through front view of the same, showing the said swaying motion of the trunk;
- in Figures 5 and 6, a side view of a leg of the doll in the extended and in the partially contracted positions, respectively;
- in Figure 7, a see-through side view of another embodiment of the doll according to the invention as it simulates the movements of walking;
- in Figure 8, a partial see-through side view of the same, showing certain parts housed inside the trunk;
- in Figure 9, a perspective view of the same, showing parts and devices of the doll seen in Figures 7

and 8, including the device that causes the trunk to sway relative to the hips and at the same time controls the articulation of the legs;

- in Figure 10, a partial see-through view of the same, showing the swaying movement of the trunk which also includes the articulation of the legs;
- in Figure 11, a detail of a leg with the inserted means for varying the length of the stride;
- in Figure 12, an enlarged detail of only that part of the leg containing the abovementioned means;
- in Figure 13, a doll according to the invention with skates for simulating the motion of a skater;
- in Figure 14, one of the skates from Figure 13, seen from below; and
- in Figure 15, an illustrative schematic representation of a doll according to the invention as its direction of walking is being modified by means of a remote control activating the means that respectively shorten and lengthen the length of one stride of each leg.

Beginning with Figure 1, this shows that a doll 1 according to the invention has first and foremost, inside the trunk 2 in the vicinity of the hips 5, a device 9 connected to the ends of the upper portions 4s of the legs 4, which it moves by causing them to turn through a given angle simultaneously, but in alternating and always mutually opposite directions, about their hinge points P on the said hips 5, thus simulating the motion of the thighs of a human being when walking.

It is not thought necessary to provide further description of an example of a first device 9 of this kind, as one of such examples, designed by the same inventor, is described in detail in Patent Application CH No. 1653/99, to which those skilled in the art and interested in studying the question should refer. Other devices of known type can of course also be applied so long as they achieve the same objects.

The said first device 9, illustrated without details in the drawings, is connected to an electric motor 6 located in the trunk 2 of the doll 1.

Connected to the said first device 9, and coupled to it in motion by means of suitable transmission and speed-reducing members 20 (see Figures 2, 3 and 4), a second device 10 causes the trunk 2 to sway rhythmically relative to the hips 5 of the doll. It does this by causing an eccentric wheel 17 mounted on the rotating shaft of the first device 9, to press alternately against the inside surfaces of two prongs 18', 18'' of a fork 18 integral with the trunk 2, which consequently rotates about a fulcrum point (not visible in the drawings) in the region of the hips 5.

The connection to the first device 9, which as stated also moves the upper parts 4s of the legs 4, must be so designed and have such transmission ratios that the trunk moves a predetermined amount with a reciprocating motion across the Y-Y axis of the doll 1, towards whichever of the two legs is extended and standing vertically on the floor or suchlike surface K on which the doll 1 is walking. This is so that the centre of gravity G (Figure 4) of the trunk 2 shifts sufficiently to compensate for the different distribution of masses that occurs when one of the two legs contracts to take a step and is supported by the surface K only via a sliding or rolling member 12 at the toe of each foot 11.

As a result of this, at every instant the doll 1 is supported by the surface K through the whole of the sole of one of the two feet 11, and through the toe only of the other, thus exactly simulating the movements of walking, the doll always being firmly supported by the said surface.

In order to achieve the above, two eccentric wheels 13, visible in all Figures 1 to 6 and mounted at relative angles of 180° on a spindle 21 (Figure 4) - which is itself driven by transmission members (not

shown) from the said first device 9 powered by the electric motor - press alternately on the upper ends 14e of two struts 14 mounted on the inside of each leg 4, and cause them to slide up and down on a guide 23 in the upper portion 4s of each leg.

Each strut 14 is hinged at its lower end 14j to the rear part of the lower portion 4j of the leg 4 near the point of articulation Z between the said upper portion 4s and lower portion 4j.

When a strut 14 is moving downwards, for obvious geometrical reasons (see Figures 5, 6) it lines up the said upper 4s and lower 4j portions of that leg 4, thereby extending it and making it vertical with respect to the surface K.

In order to ensure that the position of each foot 11 is properly coordinated with respect to the lower portion 4j of the leg 4, to which it is articulated at a point H, the inventor has applied a brace 15 hinged at its top end 15s to the upper portion 4s of the leg 4, in the vicinity of its point Z of articulation to the lower portion 4j, and at the bottom end 15j to the top of the foot 11 in the vicinity of its point of articulation H.

The said brace 15, fitted as stated, thus forms with the parts of the leg 4 and with the foot 11 a four-bar chain, with the consequence that, when the upper portion 4s of the leg 4 tilts relative to the surface K while taking a step, the foot 11 tends to keep parallel to it, and it too tilts relative to the same surface, as shown in Figure 6, as far as a position in which it touches the surface only at a point Q of the rolling member 12 mounted on its toe.

In the interval of time in which the leg 4 is reaching this condition the said leg, bent at the points of articulation P, Z, H, and relieved of some of the weight acting on it owing to the said swaying motion of the trunk 2 of the doll 1, is able to advance one step, while for the same reason the other leg,

extended and essentially vertical, takes most of the weight of the doll.

When, because of the action of the said first device 9, the situation is reversed, and the leg hitherto described as bent (owing to the action of the return spring 16 causing the knee to bend) at its points of articulation P, Z and H, now extends vertically, the said second device 10 transfers most of the weight to it, and the other, previously extended leg is bent as previously described and takes the next step.

The said first device 9 and the second device 10 must of course be correctly in phase with each other, with transmission ratios such as to ensure precise synchronized coordination between the movements of the different parts of the doll 1 according to the invention.

Another embodiment 101 of the doll of the invention, illustrated in Figures 7 to 10, does not use the eccentric members 13 described above for extending and contracting each leg 4. Instead, the inventor employs components 22, one on each flank, which are caused to move vertically up and down by the said swaying of the trunk 2, to which they are connected by a hinge 22e so that they can also rotate slightly, adapting to the swaying of the trunk 2, while moving vertically.

These moving components 22 press at their lower ends on the upper ends 14e of the said struts 14, thereby automatically, in the manner described earlier, causing the leg on which they are acting to extend, making it vertical and at the same time shifting some of the weight of the trunk 2 onto it. This solution is simpler and less expensive and obviates the need for transmission and speed-reducing members connected to the device 9 (or directly to the electric motor 6,), as is however necessary in the embodiment described first.

In both embodiments of the articulation of the legs it is advisable for the parts to be designed in

such a way that, at all times, the distance D between the point of contact Q of the rolling or sliding member 12 and the point P of articulation of the corresponding leg 4 to the hip 5 remains approximately constant.

In order to make it possible to change the direction in which a doll according to the invention is walking, the inventor has also provided the abovementioned braces 15 that connect the upper part 4s of each leg 4 to the corresponding foot 11, shaping the upper end 15s in such a way that it forms an L with the short side oriented towards the leg and capable of being displaced axially by the translational movement of a first worm 30 (Figures 11 and 12), to the end of which this short side is fixed coaxially. (This first worm 30 may also itself form the said short side of the L connected to the end of the vertical side of the brace 15).

For obvious geometrical reasons, increasing the distance M of the vertex of the said L from the leg 4 also increases the height by which the heel 35 of the foot 11 is raised relative to the floor or suchlike surface K, extending the period of time during which, owing to the forward movement of the leg 4 and its simultaneous bending, the heel 35 remains off the surface and does not resist its forward movement. It is obvious that it is useful to make the heels 35, fitted underneath each foot 11, from a material with a high coefficient of friction on the material of the floor or suchlike surface K, in order to at once resist any further forward movement of the leg 4 as soon as the corresponding heel 35 is placed on the surface.

Clearly, by adjusting the length of the steps taken by the two legs 4, the doll can be made to rotate about one leg as it advances, this being the leg that takes the shorter steps. The doll will therefore turn towards the right or towards the left.

The direction in which a doll 1 is walking can also be modified by means of a remote control 34

(Figure 15), by activating one of the independent electric motors 33 situated inside each of the two legs 4 so as to turn, in either direction, to a greater or lesser degree, a second worm 32 meshing with a helical wheel 31 that has, on its inside, helical starts that engage with the said first worm 30 and displace it axially when the said helical wheel 31 is rotated.

The motor speed can thus be reduced sufficiently to bring about the desired speed of axial displacement of the short side of the said L of the brace 15. (For dolls of ordinary dimensions the maximum axial excursion of this short side of the L is of the order of approx. 1-3 mm.)

By designing the parts appropriately it is even possible to reduce the length of stride of a leg practically to zero, so that the doll rotates about it. (It should be pointed out that when the description refers to a foot 11 of the doll, a foot with or without a shoe is meant.)

The inventor has also envisaged fitting a skate 37 (Figures 13, 14) under each foot 11 so that the doll appears to be skating as it walks.

The said skate 37 must be provided on its underside with a plurality of components 38 (rollers, in the simplest case) fitted with a device that will prevent them rotating in a direction that would cause the doll to move in the opposite direction to the forward.

In the case depicted, this device is a simple escapement 39 that fits into grooves formed on the outside of at least one of the wheels 38. This arrangement is necessary in order to ensure that the doll does not walk on the spot without advancing, or worse still slide backwards, and has a function equivalent to that of the heels described earlier in ordinary walking without skates.

The batteries 7 that drive the electric motor 6 can be located, as seen in Figure 1, in the lower portion 4j of each leg of the doll 1.

This is an economical and relatively simple way of avoiding the need for sophisticated, high-cost devices to produce a doll 1, 101 that correctly simulates the movements of walking in the sense that all its parts equally correctly simulate the movements of the corresponding anatomical parts of a human being.

The object towards which the inventor was working is therefore fully achieved.

In designing the various component parts of a doll according to the present invention, it is of course advisable to make them such that their masses contribute as far as possible to increasing the stability of the doll and/or preventing it from potentially falling over.

It is advantageous for this purpose to ensure that the centre of gravity G is as close as possible to the floor or suchlike surface K, and that the mass of the feet 11 is relatively great.

It should be added that if it is decided not to have the trunk 2 sway during walking, the embodiment described latterly can still be carried out except that the said fork 18, which also causes the legs 4 to move, is not connected to the trunk and is simply housed appropriately inside it (this form is not shown in the drawings).

It is also possible to produce a doll according to the invention in which the trunk is made to sway as described by the eccentric wheel 17 and the said two-pronged fork 18, but the legs are moved by the action of the eccentric wheels 13 already explained in the embodiment described first.

Claims

1. Doll (1) provided with a trunk (2), arms (3) and, hinged to the hips (5), legs (4), the doll being such that it can be animated in such a way as to simulate the movements of walking on a floor or suchlike surface (K), and characterized in that it comprises:

a) an electric motor (6) powered by batteries (7); and

b) a first device (9) situated inside the trunk (2) in the vicinity of the hips (5) of the doll (1), driven by the said electric motor (6) and connected to the ends of the upper portions (4s) of the legs (4) in such a way as to cause them to turn simultaneously in alternating and always mutually opposite directions through a predetermined arc of rotation about their hinge points (P) on the said hips (5), each of the two legs (4) comprising, articulated together, an upper portion (4s), a lower portion (4j) and a foot (11), and being equipped with means (13, 14, 15, 16, 17, 22) which, for a predetermined rotation of the upper portion (4s) of a leg (4) in the direction of motion of the doll (1), cause relative rotations simulating the movements of walking between the upper portion (4s) and the lower portion (4j) and between the latter and the foot (11) of that leg (4) which is moving forwards because of the action of the said first device (9), the said foot (11) having on its toe a rolling or sliding member (12) that remains permanently in contact with the said floor or suchlike surface (K).

2. Doll according to Claim 1, in which the abovementioned means that cause the said relative rotations between the upper portion (4s) of each leg (4) and the lower portion (4j), and between the latter and the foot (11) connected to it, consist of:

- an eccentric member (13) of horizontal axis (21) which, during its rotation caused by the said first device (9) to which it is connected, presses on

the upper end (14e) of a strut (14) which moves laterally up and down the upper portion (4s) of the leg (4) and is hinged at its lower end (14j) to the rear part of the lower portion (4j) of the leg (4) in the vicinity of the point of articulation (Z) between its said upper (4s) and lower (4j) portions;

- a brace (15) hinged at its top end (15s) to the upper portion (4s) of the leg (4) in the vicinity of its point of articulation (Z) to the said lower portion (4j), and hinged at its bottom end (15j) to the top of the foot (11) in the vicinity of its point of articulation (H) to the said lower portion (4j) of the leg (4), the two eccentric members (13) associated with the two legs being mounted with an angular phase difference of 180° so that they press alternately on the said upper ends (14e) of their respective struts (14).

3. Doll according to one of the preceding claims, provided additionally with a fork (18) attached to the trunk (2) and composed of two prongs (18', 18'') between which an eccentric wheel (17) presses alternately against one of these prongs, thus causing a rhythmical swaying of the said trunk (2) to either side so that the centre of gravity (G) is displaced towards whichever of the two legs (4) is most vertical with respect to the floor or suchlike surface (K).

4. Doll according to Claim 1, in which the said means (14, 15, 16, 17) that cause the said relative rotations between the various parts of each leg (4) comprise:

- a component (22), able to move laterally with respect to the trunk (2), that executes a vertical reciprocating movement because of its connection to a fork (18) composed of two prongs (18', 18'') between which an eccentric wheel (17), worked by the said first device (9), presses alternately against one of the said prongs (18', 18''), the lower part of the said component (22) exerting pressure on the upper end (14e) of a strut (14), which is designed to move laterally up

and down the upper portion (4s) of the leg (4) and is hinged at its lower end (14j) to the rear part of the lower portion (4j) of the leg (4) in the vicinity of the point of articulation (Z) between its said upper (4s) and lower (4j) portions;

- a brace (15) hinged at its top end (15s) to the front part of the upper portion (4s) of the leg (4) in the vicinity of its point of articulation (Z) to the said lower portion (4j) and hinged at its bottom end (15j) to the top of the foot (11) in the vicinity of its point of articulation (H) to the lower portion (4j) of the leg (4).

5. Doll according to Claim 3, in which the said eccentric wheel (17) acting on the said two-pronged (18', 18'') fork (18) is mounted transversely with respect to the direction of the walking movement of the said doll (1) and is fixed to the trunk (2) which therefore also, being hinged to the hips (5), sways in such a way as to displace its centre of gravity (G) transversely towards whichever of the two legs (4) is most vertical with respect to the floor or suchlike surface (K) on which the doll (1) is walking.

6. Doll according to one of the previous Claims 2 to 5 in which there is attached to each strut (14) a spring (16) which is extended by tension by the strut (14) when the strut is pushed down and which pulls it back up again when the pressure exerted on the strut is removed, so bending the knee.

7. Doll according to one of Claims 2 to 6, in which the said means (13, 14, 15, 16, 17, 22) that bring about the said relative rotations between the various parts of one leg (4) are shaped, positioned and given dimensions such that the distance (D) between the point of articulation (P) of the leg (4) and the point of contact (Q) between the said rolling member (12) and the floor or suchlike surface (K) is at all times approximately constant.

8. Doll according to one of Claims 2 to 7, in which the top end (15s) of each brace (15) is shaped

where it hinges on the upper portion (4s) of the respective leg (4) in such a way as to form an L, the short side of which is oriented roughly perpendicularly towards this leg and is provided with means (30, 31, 32, 33) capable of displacing the said side horizontally by a defined distance in both directions, each foot (11) being provided with a heel (35) of a material with a high coefficient of friction relative to the floor or suchlike surface (K) which is raised with each step by the latter by an amount that increases with the distance (M) of the vertex of the said L from the upper portion (4s) of the leg (4).

9. Doll according to Claim 8, in which the short side of the abovementioned L is attached to the end of a first worm (30) rotated by a helical wheel (31) coupled to it and itself driven by a second worm (32) driven by its own electric motor (33), which motor, together with, the said first (30) and second (32) worms and the said helical screw (32), are all housed inside the upper portion (4s) of the leg (4), and the said electric motor is controllable by a remote control (34).

10. Doll according to one of the preceding claims, each of the feet (11) of which is fitted with a skate (37) that rests on the floor or suchlike surface (K) via components (38) capable of rotating only in the direction in which the doll (1) is walking.

11. Doll according to one of the preceding claims, in which the said batteries (7) are housed in the lower portion (4j) of each leg (4).

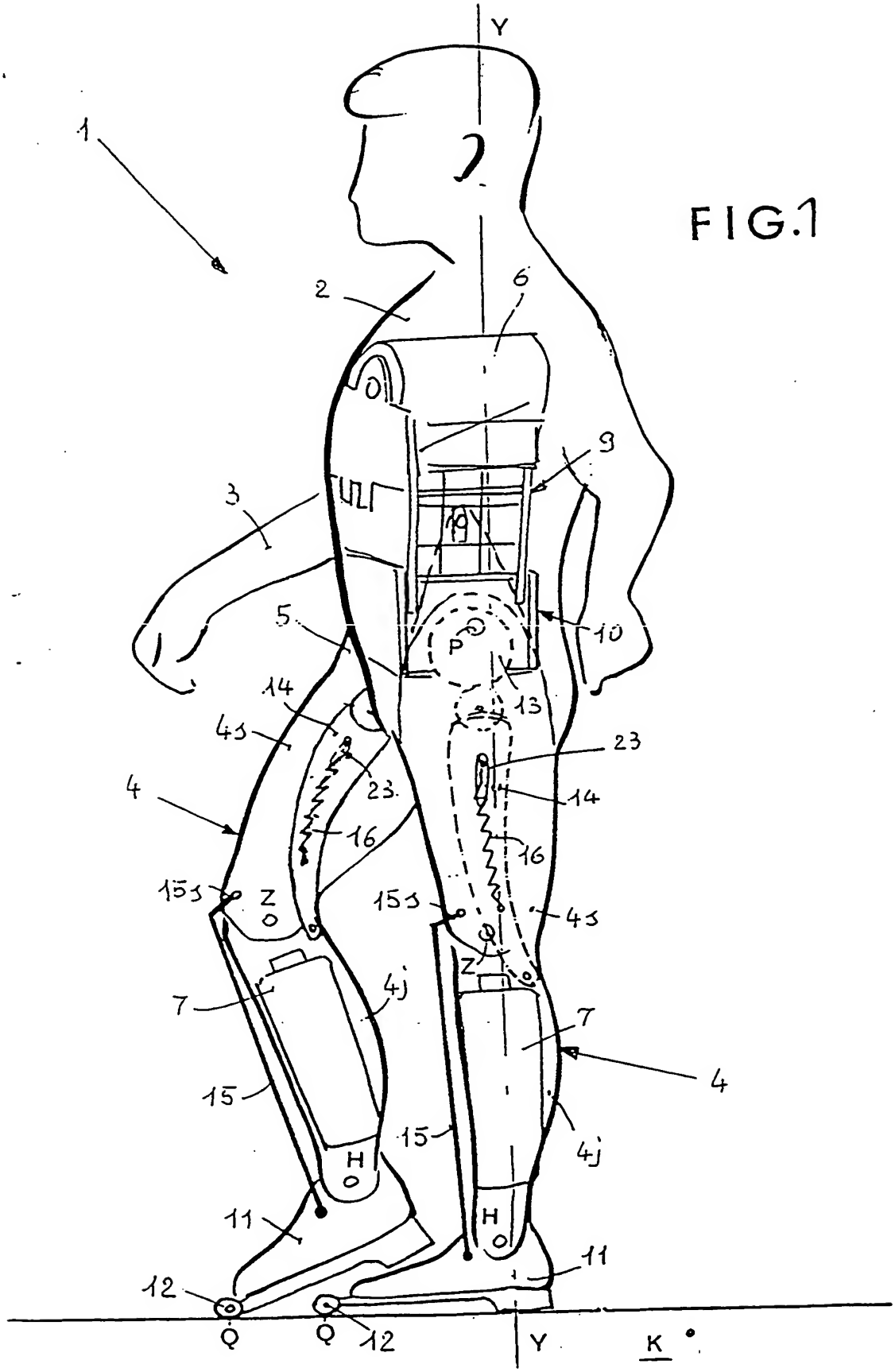


FIG.1

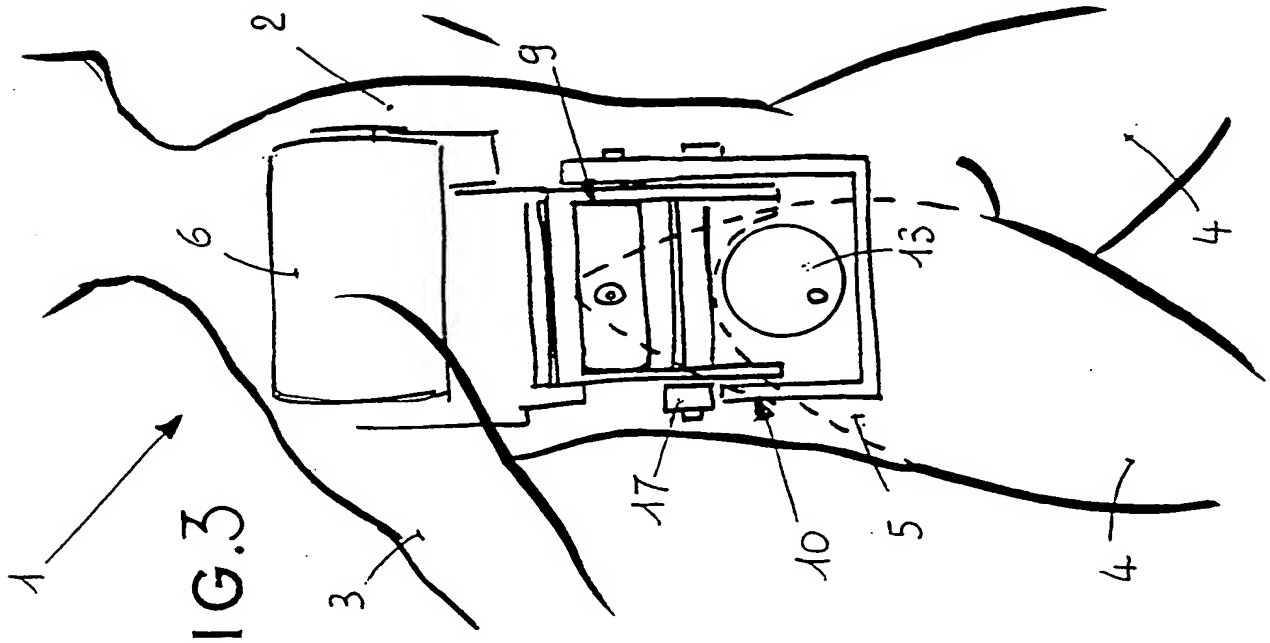


FIG.3

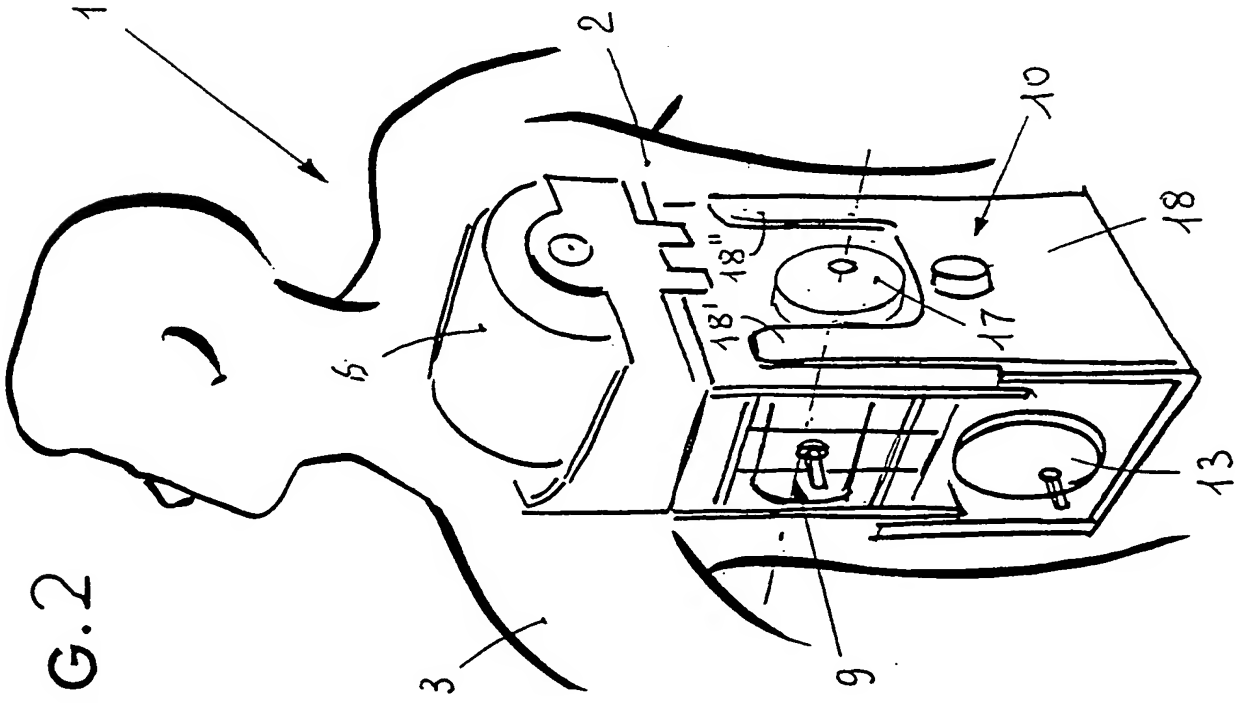


FIG.2

FIG.4

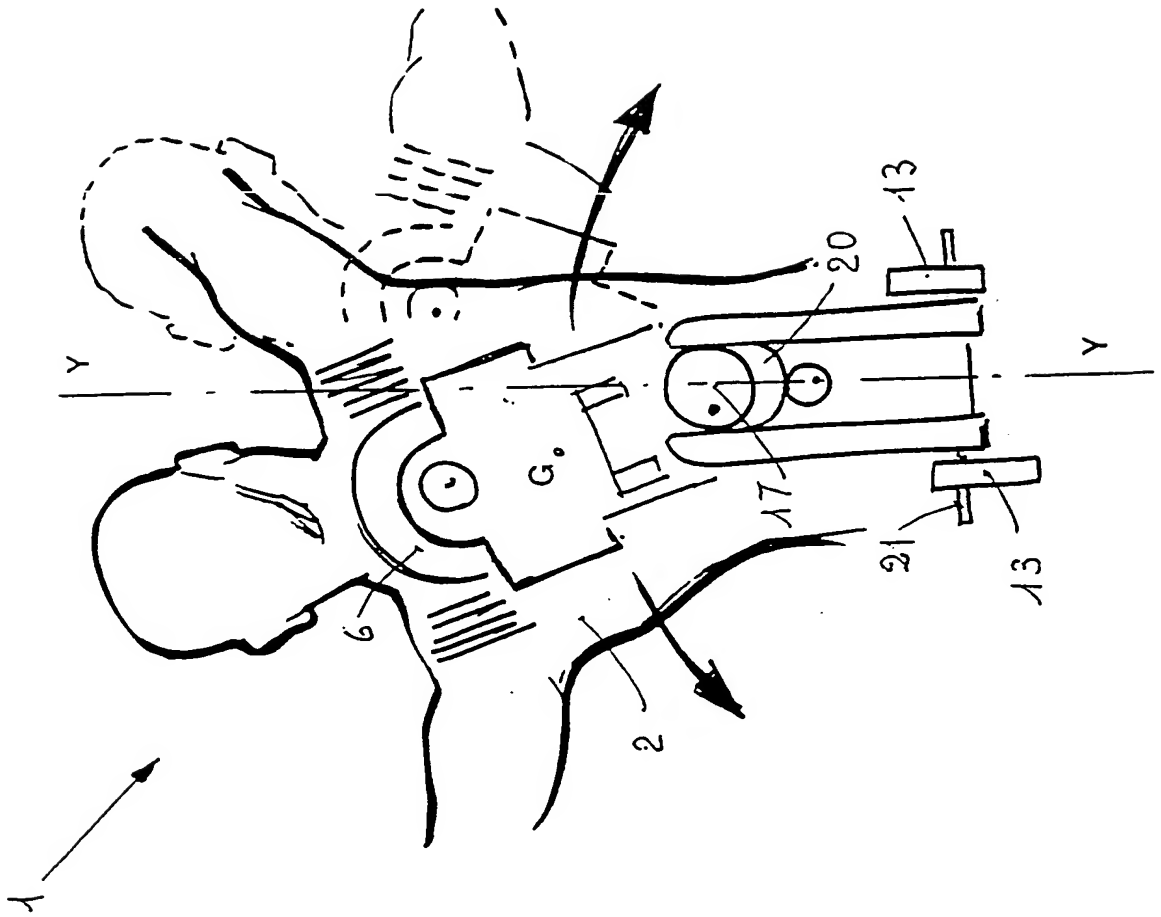


FIG.5

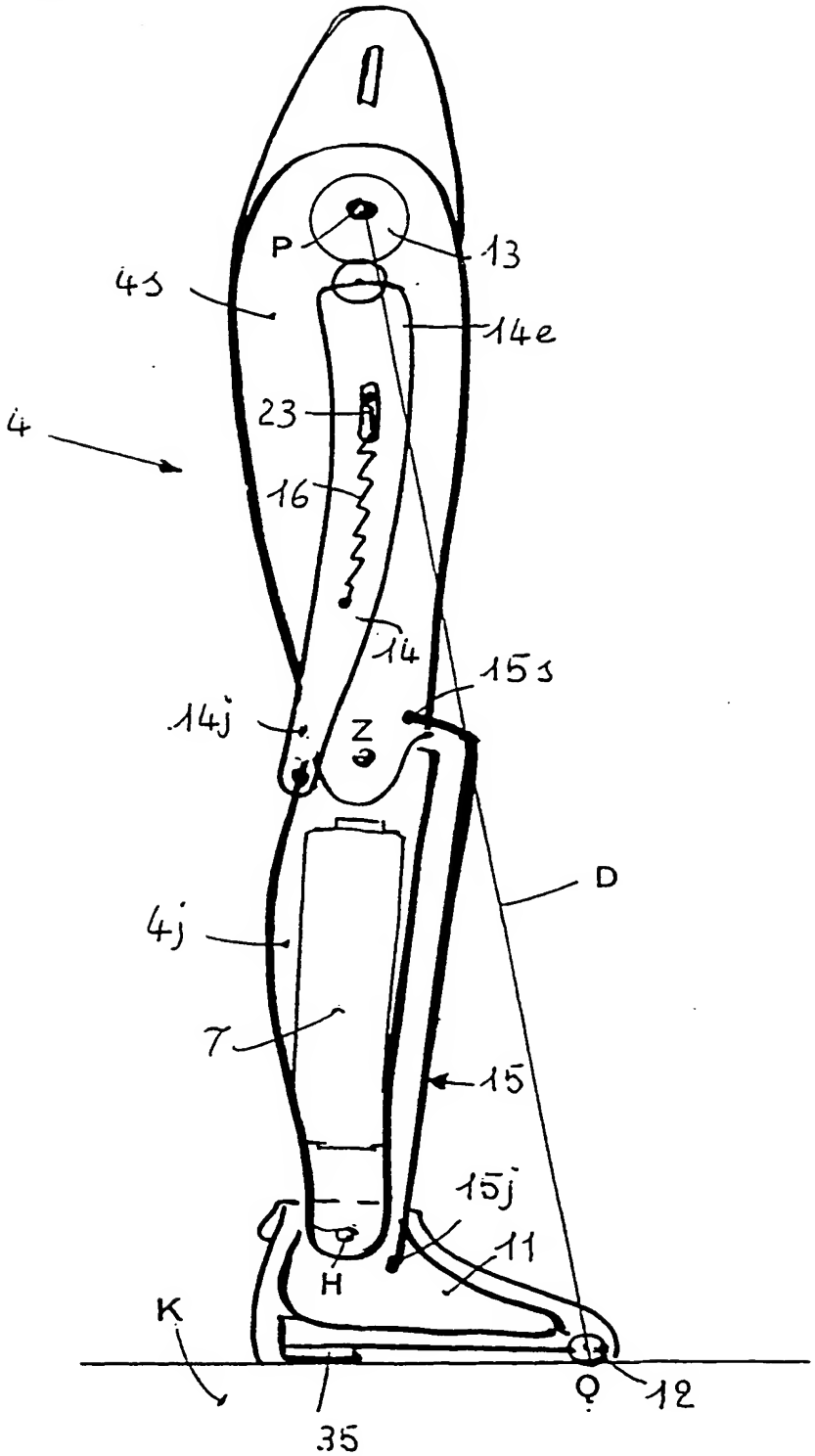


FIG. 6

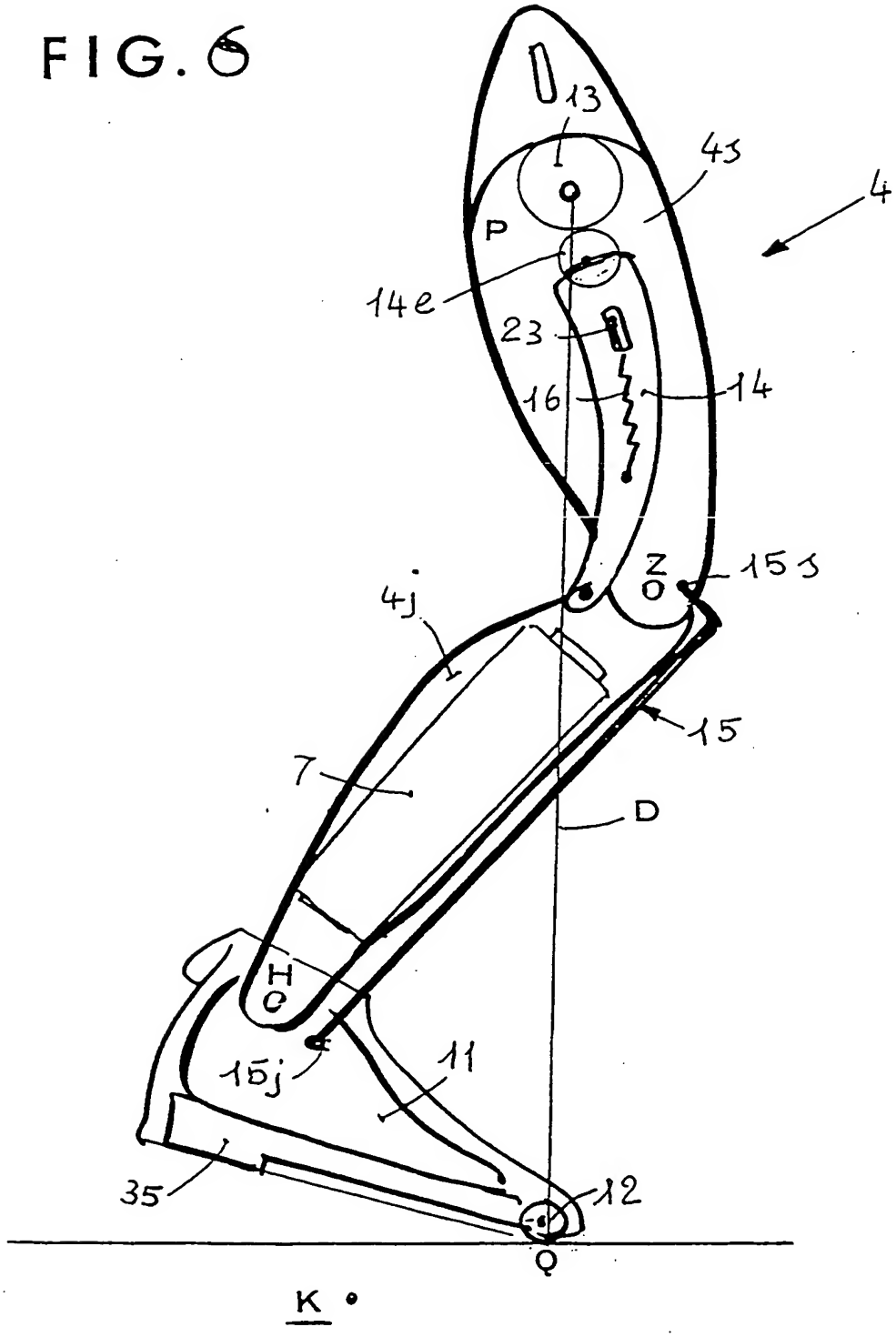


FIG. 7

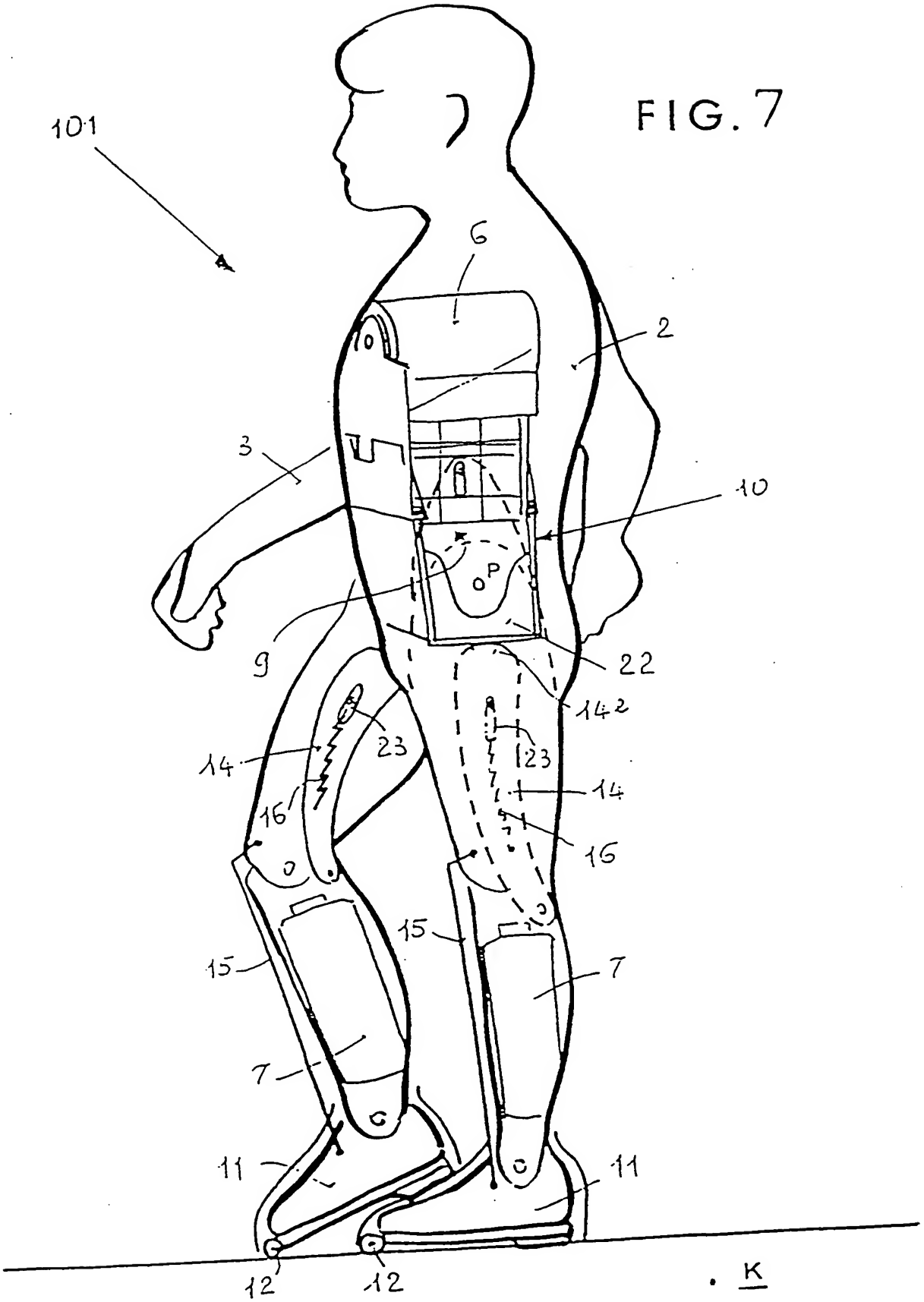
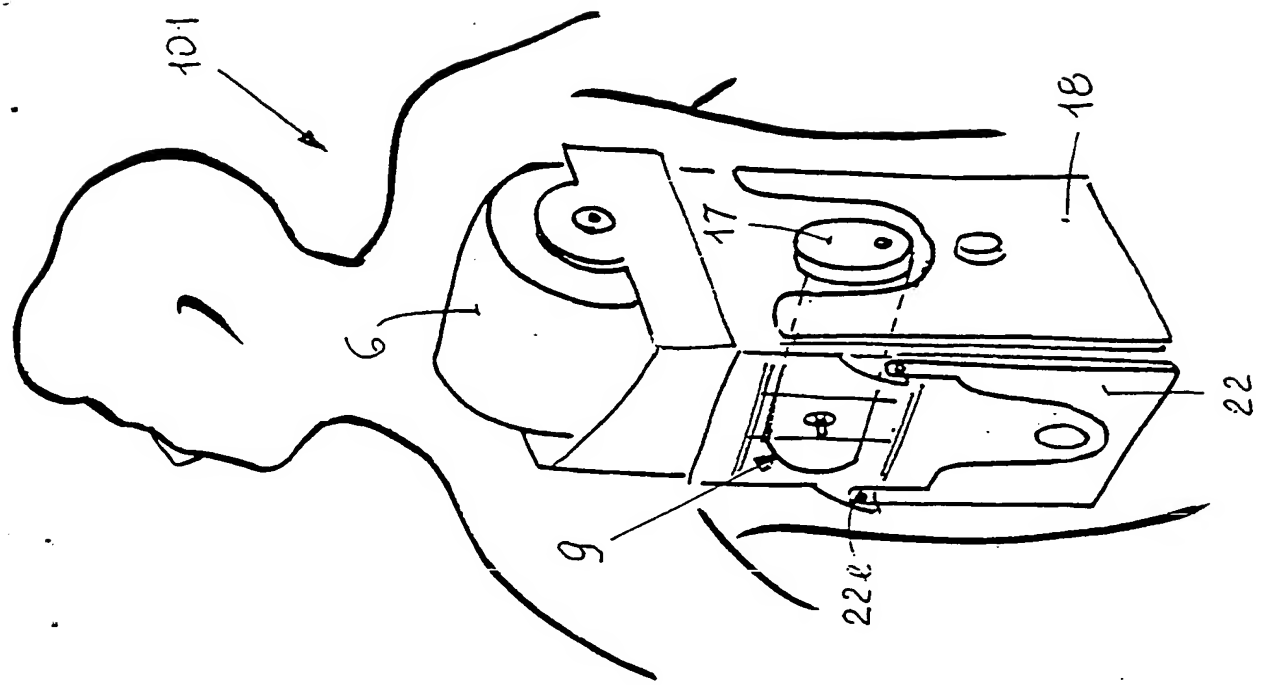


FIG.9



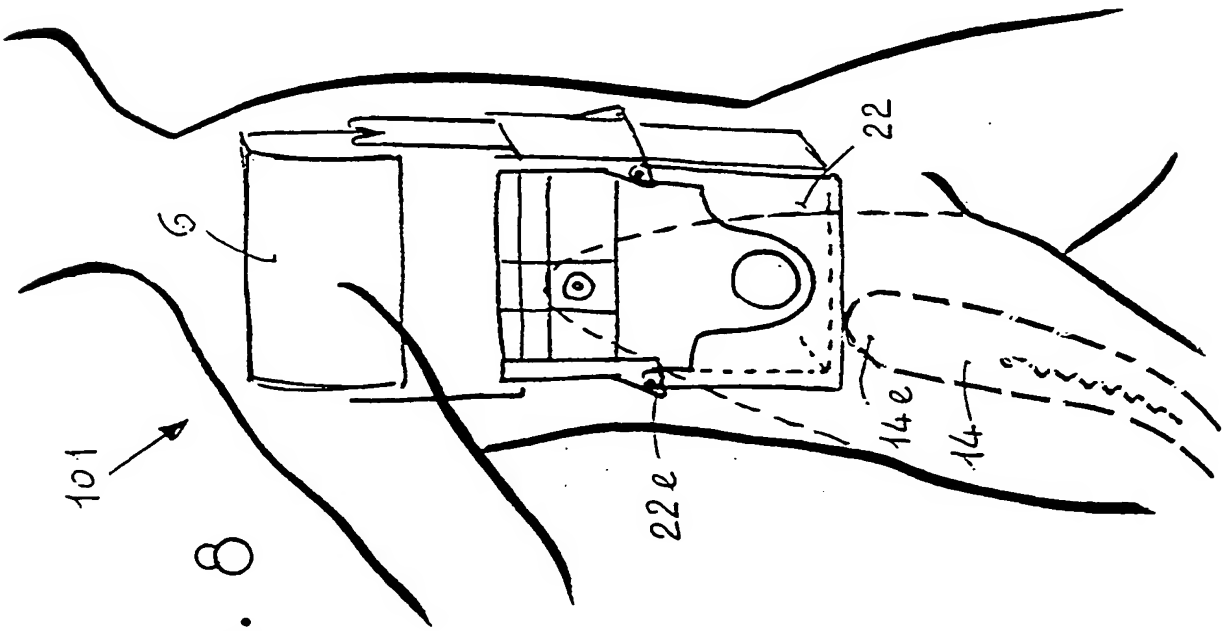
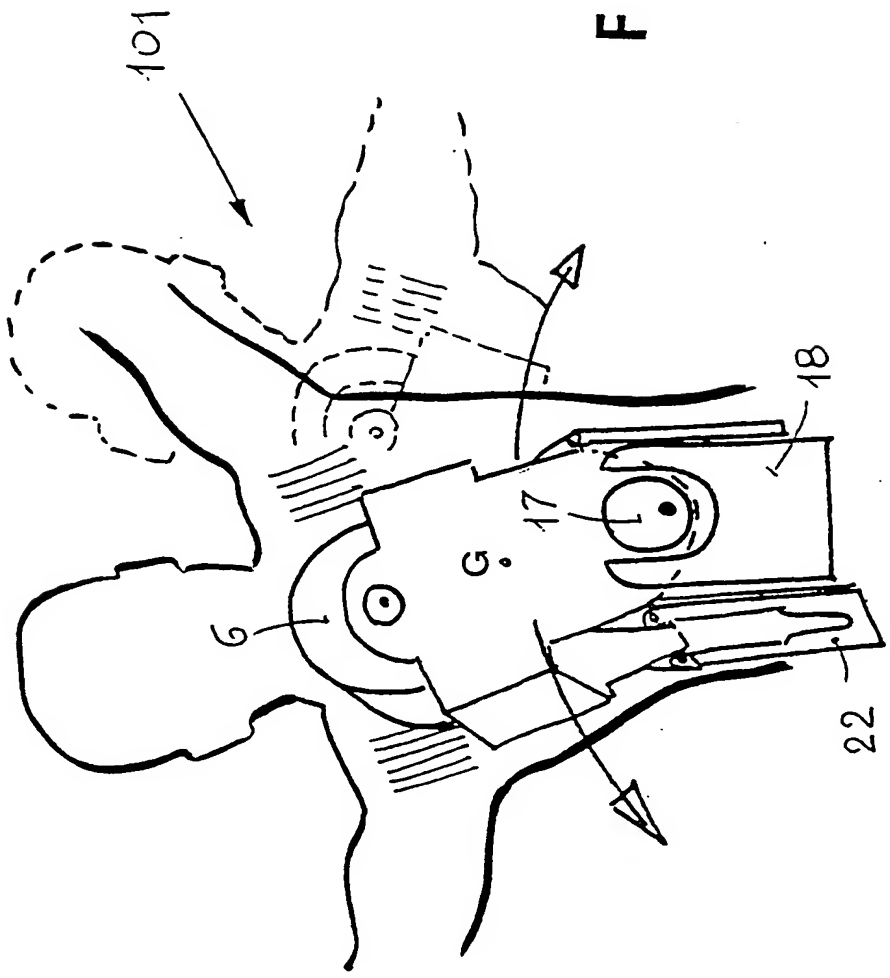


FIG. 8

FIG.10



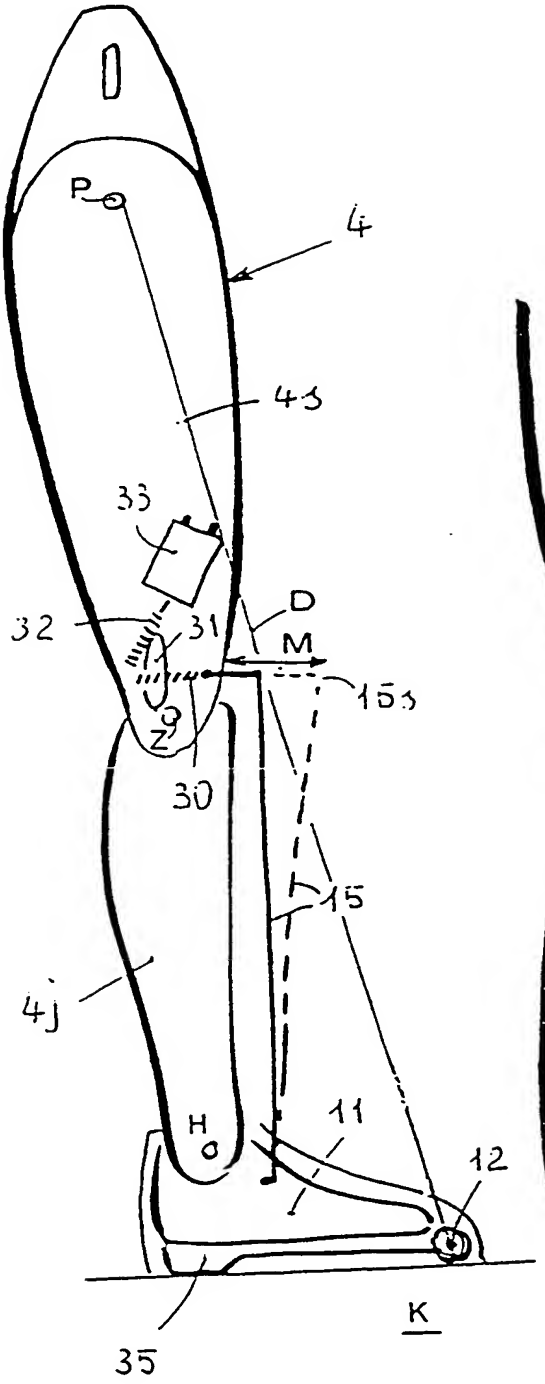


FIG.11

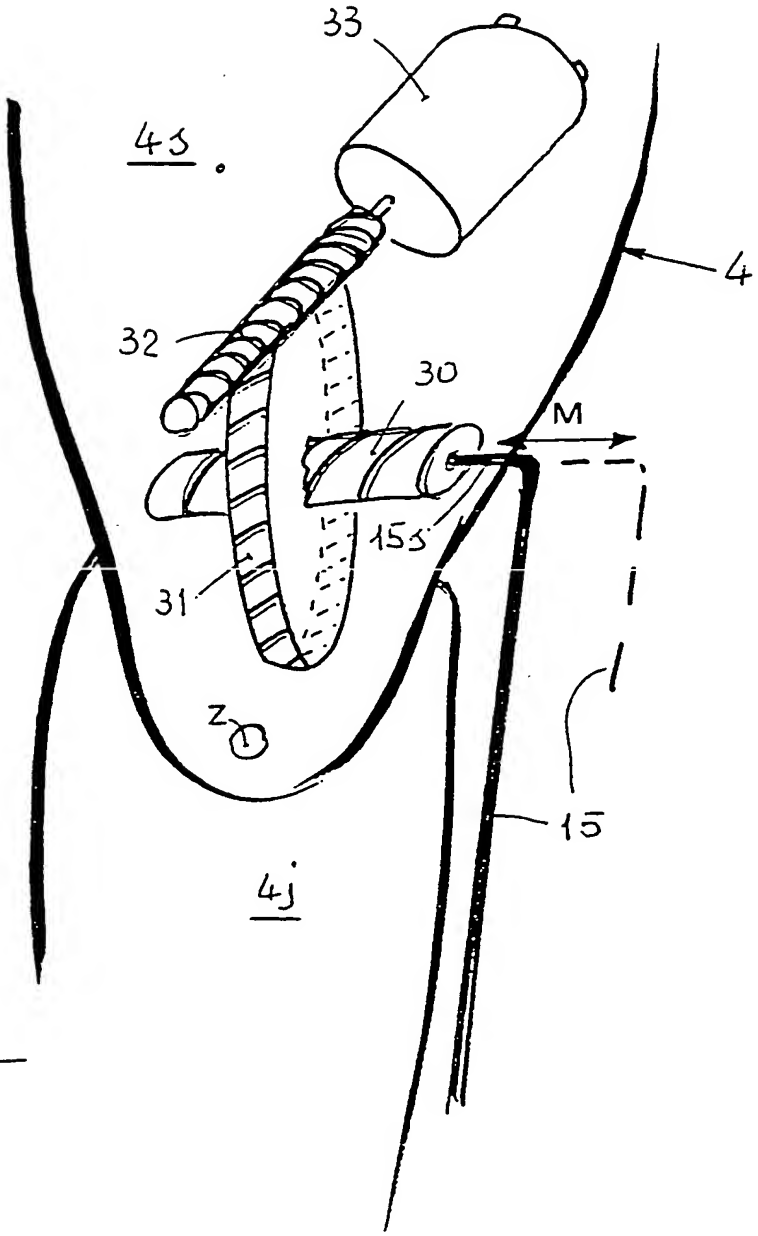
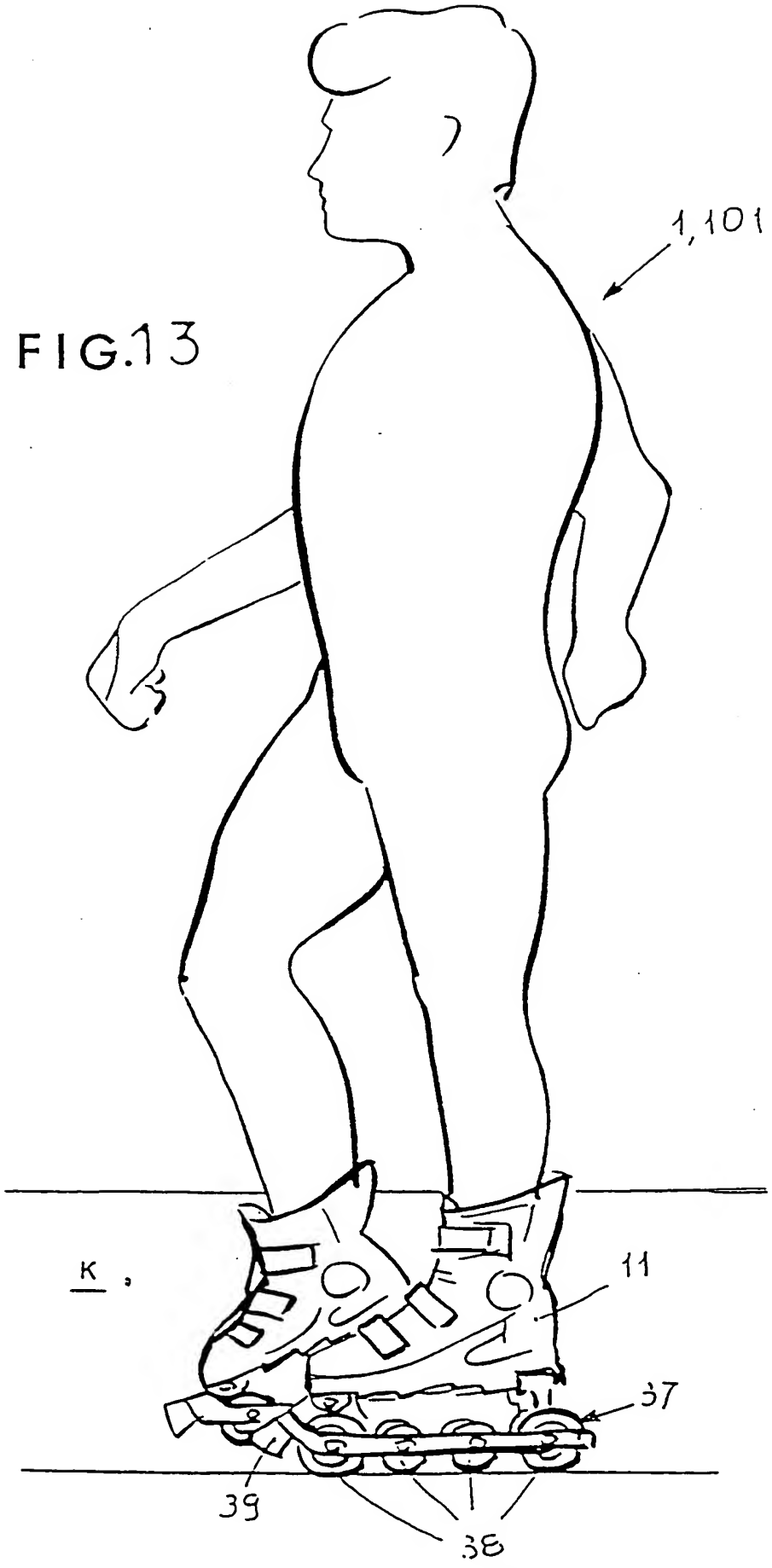


FIG.12

FIG.13



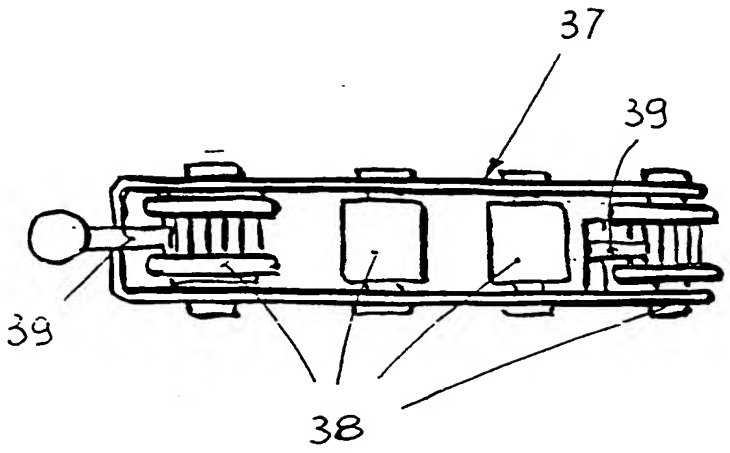


FIG.14

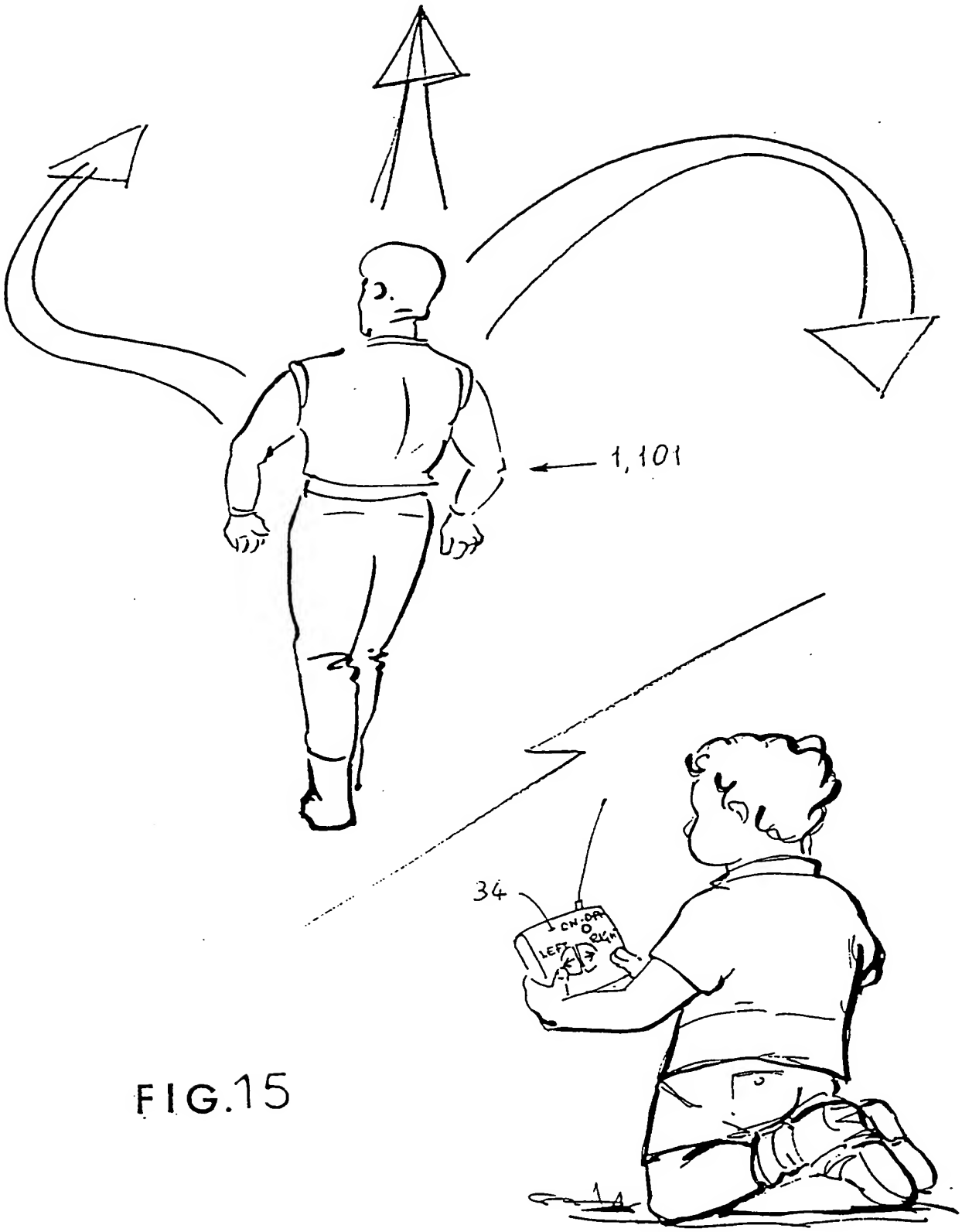


FIG.15

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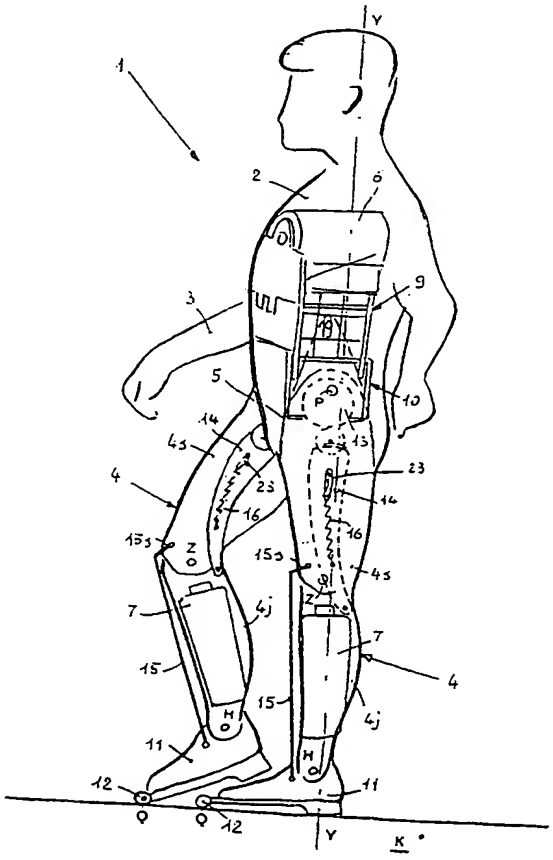
[Continued on next page]

(54) Title: DOLL SIMULATING A WALKING ACTION



(57) Abstract: A description is given of a doll (1) provided with a trunk (2), arms (3) and, hinged to the hips (5), legs (4), which simulates walking. It comprises: a) an electric motor (6) with batteries (7); b) a device (9), driven by the electric motor (6), that rotates the upper portions (4s) of the legs in mutually opposite alternating directions. Each leg (4) is composed of an upper portion (4s), a lower portion (4j) and a foot (11), these being articulated to each other, and comprises means (13, 14, 15, 16) that cause them to rotate relative to each other when the leg (4) contracts in order to take a step, while nonetheless keeping a constant distance between the articulation (P) of the leg (4) to the hip (5) and the point of contact (Q) on the floor or suchlike surface (K) by which a rolling member (12) at the toe of the foot (11) is supported at all times.

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IPC 7 A63H11/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A63H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 224 896 A (TERZIAN ROUBEN T) 6 July 1993 (1993-07-06) column 2, line 59 -column 7, line 18; figures	1
A	WO 92 21416 A (MATTEL INC) 10 December 1992 (1992-12-10) page 7, line 3 -page 12, line 22; figures 2,3	1
A	US 5 326 302 A (LLORENS JAIME F) 5 July 1994 (1994-07-05) abstract; figures	1
A	US 5 045 015 A (ARAD AVI ET AL) 3 September 1991 (1991-09-03) abstract; figures	1

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Date of the actual completion of the international search	Date of mailing of the international search report
24 September 2001	04/10/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Lucas, P

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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